

# Non-employment and changes in smoking, drinking, and body weight

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## Abstract

**Objective**—To assess the effect of unemployment and early retirement on cigarette smoking, alcohol consumption, and body weight in middle aged British men.

**Design**—Prospective cohort study (British regional heart study.)

**Setting**—One general practice in 24 towns in Britain.

**Subjects**—6057 men aged 40-59 who had been continuously employed for five years before the initial screening. Five years after screening 4412 men had been continuously employed and 1645 had experienced some unemployment or retired.

**Main outcome measures**—Numbers of cigarettes smoked and units of alcohol consumed per week and body mass index ( $\text{kg/m}^2$ ).

**Results**—At initial screening significantly higher percentages of men who subsequently experienced non-employment smoked or had high alcohol consumption than of men who remained continuously employed: 43.0% versus 37.0% continuously employed for cigarette smoking (95% confidence interval for difference 3.2% to 9.0%) and 12.1% versus 9.0% for heavy drinking (1.3% to 5.1%). There was no evidence that men increased their smoking or drinking on becoming non-employed. Men non-employed through illness were significantly more likely to reduce their smoking and drinking than men who remained continuously employed. Men who experienced non-employment were significantly more likely to gain over 10% in weight than men who remained continuously employed: 7.5% versus 5.0% continuously employed (0.9% to 4.0%).

**Conclusions**—Loss of employment was not associated with increased smoking or drinking but was associated with an increased likelihood of gaining weight. The long term effects of the higher levels of smoking and alcohol consumption before non-employment should be taken into account when comparing mortality and morbidity in groups of unemployed and employed people.

## Introduction

Many cross sectional studies have found that unemployed men are more likely to smoke cigarettes and to consume more alcohol than employed men.<sup>1-10</sup> There are two possible explanations for this: firstly, loss of employment leads to increased smoking and drinking or, secondly, people who lose employment smoke and drink more heavily before losing employment compared with people who remain employed. We have examined these two explanations in a group of middle aged men using prospective data collected as part of the British regional heart study.

To overcome the possible effects on smoking and drinking habits of recurrent unemployment (often due to illness) over long periods we restricted our analysis to men who had been continuously employed for the five years before the initial screening. We attempted to control for other background factors that might confound the relation, such as age, social class, area of residence, and reason given for loss of employment. In

particular health status may be an important confounding factor. Certain illnesses are known to be potent factors in persuading men to stop smoking as well as affecting employment prospects.

## Subjects and methods

In 1978-80, men aged 40-59 were randomly selected from general practices in 24 towns in England, Wales, and Scotland to form the study population of the British regional heart study. The response rate was 78%, and 7735 men were screened. The criteria for selecting the towns and general practices and the methods of data collection have been reported.<sup>11</sup> Research nurses administered to each man a standard questionnaire which included questions on occupational history, employment status, smoking habits, alcohol intake, and usual patterns of physical activity. Each man was weighed in trousers and socks to the nearest 0.1 kg on an MPS110 field survey scale (beam balance), and height was measured without shoes to the nearest millimetre with a stadiometer (Harpender) with digital meter. Five years later (1983-5) we sent a postal questionnaire to all surviving men still resident in Britain ( $n=7397$ ) and detailed information was obtained from 7275 (98%) men on changes in smoking behaviour, past and present drinking habits, current weight, and information on employment status five years before and after screening.

The men were classified into employment groups based on their employment experience over the five years after screening, with an emphasis on their employment status at the time of the postal questionnaire: (a) continuously employed throughout the five years after screening and still employed at the time of the postal questionnaire; (b) discontinuously employed (that is, employed at initial screening and at the time of the postal questionnaire but unemployed at some time between the two); (c) unemployed because of illness at the time of the questionnaire; (d) unemployed for reasons other than illness at the time of the questionnaire; (e) retired because of illness at the time of the questionnaire; and (f) retired for reasons other than illness at the time of the questionnaire. Men who were working part time (134) were excluded because of uncertainty about whether to classify them as employed. Twenty nine men were not classified because of incomplete data, leaving 7112 men for analysis.

The reason for not being employed was based on each man's self assessed reason. Therefore those not employed because of ill health will be heterogeneous in respect of the type and severity of the illnesses experienced.

Social class was determined from each man's longest held occupation at screening by using the six social classes of the Office of Population Censuses and Surveys.<sup>12</sup> Occupational information was not available for 10 men.

**Cigarette smoking**—Men were classified according to their reported smoking habits: never cigarette smokers, ex-cigarette smokers, light smokers (1-19 cigarettes a day), moderate smokers (20 cigarettes a day), and heavy smokers (more than 20 cigarettes a day). This categorisation was chosen because of the distribution

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of the data, with an extremely large percentage of men smoking 20 cigarettes a day (one pack) and very few smoking 16-19 or 21-24 a day. Men who currently smoked pipes or cigars and had never smoked cigarettes were classified as never having smoked cigarettes and men who currently smoked pipes or cigars and had smoked cigarettes in the past were classified as ex-cigarette smokers. Data were missing on 12 men at screening and 30 men at the postal questionnaire.

**Alcohol consumption**—The men were classified into five groups on the basis of their estimated average alcohol consumption in units per week: non-drinker, occasional drinker (<1 unit), light drinker (1-15), moderate drinker (16-42), and heavy drinker (>42 units). A unit was equivalent to half a pint of beer; a single whisky, gin, or brandy; or a glass of wine or sherry (about 8-10 g alcohol). Data were missing on two men at screening and 76 men at the postal questionnaire.

**Weight**—Body mass index was calculated as weight/height<sup>2</sup> and used as an index of relative weight. Bray's classification of relative weight<sup>13</sup> was used to define men as underweight if their body mass index was less than 20 kg/m<sup>2</sup> and obese if their index was equal to or greater than 30 kg/m<sup>2</sup>. The men were classified into six groups based on weight change calculated as the percentage change in body weight since initial screening: loss >10%; loss of 4-10%; stable; gain of 4-10%; gain of 11-15%; and gain >15%. Data were missing on one man at screening and 127 men at the postal questionnaire.

**Physical activity**—At screening men were asked to indicate their usual pattern of physical activity, under the headings of regular walking or cycling, recreational activity, and sporting (vigorous) activity. Physical activity at work was excluded, but few middle aged men do physically demanding work. Regular walking and cycling related to weekday journeys, which included going to and from work. Recreational activity included gardening, walking for pleasure, and do it yourself jobs. Men were classified as inactive if they did no physical activity or regular walking or did infrequent recreational activity. Data were missing on 70 men at screening and no data were collected on physical activity in the postal questionnaire.

To determine the effect of becoming non-employed (unemployed or retired) on alcohol consumption, cigarette smoking, and body weight the analysis was restricted to those men who were employed at screening. Unemployed men are likely to have experienced previous periods of unemployment,<sup>14</sup> and thus to reduce the effects of previous unemployment a further criterion was applied—that the men had to have been continuously employed for at least five years before the initial screening. Out of 7112 men, 6057 were employed at screening and had experienced no unemployment in the previous five years. Most of these men (72.8%, n=

4412) remained employed full time throughout the five years and they formed the comparison group in all analyses.

#### STATISTICAL ANALYSIS

The percentages in the tables have been adjusted for age, social class, and town of residence as these factors may affect the levels of smoking, drinking, and physical activity and the distribution of body weight.<sup>15</sup> Because of small numbers the percentages of heavy smokers and heavy drinkers reducing their levels of smoking and drinking respectively could not be adjusted for town of residence. The effects of town of residence on these changes, however, seem to be small. Unless otherwise indicated the adjusted proportions were calculated by fitting logistic regression models and by using the marginal prediction method described by Wilcosky and Chambless.<sup>16</sup> Changes in weight were analysed by fitting a nominal polytomous regression model on the six separate weight change categories.<sup>17</sup> Town of residence did not affect the probability of weight change and so was not adjusted for. The adjusted proportions were again calculated by the marginal prediction method. All the models were fitted by using Proc Logist<sup>18</sup> or Proc Catmod<sup>19</sup> in the SAS Institute package. Complete tables containing 95% confidence intervals are available from the authors. Tests of heterogeneity are included in the tables to indicate differences between the non-employment groups.

#### Results

Table I provides summary data on the age and social and geographical status of the different employment groups. The geographical distribution of the groups is summarised by the percentage of men living in the "North"—that is, north of a line from the Bristol Channel to the Wash. The continuously employed and discontinuously employed men were on average more than two years younger than men who became unemployed, with the men who retired being older still. Many of the retirements were in men aged under 60 and, because of the age groups being studied, nearly all were in men under 65. Those who had retired for reasons other than illness and the continuously employed were reasonably similar in terms of social class and geography, while the other groups were more likely to be manual workers and to live in the north.

#### CIGARETTE SMOKING

Table II shows the adjusted percentages of never smokers, current smokers, and heavy smokers in the different employment groups both at initial screening and at the postal questionnaire five years later. The adjusted percentages of men who stopped smoking and the percentages of heavy smokers who reduced or stopped smoking are also given.

At the initial screening, compared with men who remained employed men who later became non-employed were more likely to be current smokers (43% v 37% who remained employed; 95% confidence interval of the difference 3.2% to 9.0%) and to be heavy smokers (15.5% v 13.1%; 0.4% to 4.7%). They were also more likely to have smoked at some time (22.1% v 26.3% who remained employed never smoked; 1.5% to 6.7%). Among men who later became non-employed, men unemployed through illness were significantly more likely to be heavy smokers and to be current smokers and less likely to have never smoked (table II). The tests of heterogeneity showed that the levels of smoking differed significantly between the non-employed groups, with those retired through illness smoking the least.

Five years later the level of smoking had fallen:

TABLE I—Characteristics of men continuously employed for five years at initial screening

Employment status at postal questionnaire (5 years later)	No (%) of men	Mean age at screening (years)	% Of manual workers (manual/total)*	No (%) from Wales, the north, and Scotland
All men	6057 (100)	49.9	56.4 (3315/5879)	4188 (69.1)
Continuously employed	4412 (72.8)	48.7	53.3 (2284/4284)	2983 (67.6)
All non-continuously employed	1645 (27.2)	53.1	64.6 (1031/1595)	1205 (73.3)
Discontinuously employed	447 (7.4)	48.4	68.8 (293/426)	319 (71.4)
Unemployed, through illness	129 (2.1)	51.1	79.2 (99/125)	106 (82.2)
Unemployed for other reasons	376 (6.2)	52.2	76.4 (282/369)	278 (73.9)
Retired through illness	211 (3.5)	55.7	64.7 (132/204)	173 (82.0)
Retired for other reasons	482 (8.0)	57.4	47.8 (225/471)	329 (68.3)

\*Members of the armed forces (n=178) excluded from both the numerator and the denominator.

TABLE II—Smoking habits at initial screening and postal questionnaire five years later and changes in smoking habits. Figures are adjusted percentages of men \*unless otherwise stated

Employment status at postal questionnaire	Initial screening				Postal questionnaire			Changes in smoking	
	No of men†	Never smoked	Current smokers	Heavy smokers	No of men‡	Current smokers	Heavy smokers	Smokers stopping smoking	Heavy smokers reducing/stopping smoking*
Continuously employed	4401	26.3	37.0	13.1	4388	29.3	8.1	26.2	53
All non-continuously employed	1644	22.1§	43.0§	15.5§	1639	33.0§	7.5	27.9	61§
Discontinuously employed	447	21.7§	42.5§	16.4§	446	35.4§	9.0	22.3	51
Unemployed through illness	129	14.6§	56.0§	23.6§	129	38.0§	5.8	35.4	75§
Unemployed for other reasons	376	18.4§	44.5§	15.8	376	35.3§	9.7	23.6	56
Retired through illness	210	25.0	42.9	16.0	209	28.2	3.1§	37.9§	86§
Retired for other reasons	482	27.4	38.2	10.7	479	28.1	5.5	31.4	63
Test of heterogeneity of percentages among the non employed $\chi^2$ on 4 degrees freedom		13.18 p=0.010	13.81 p=0.008	14.65 p=0.006		10.20 p=0.037	13.62 p=0.009	11.79 p=0.002	15.84 p=0.003

\* All percentages adjusted for age, social class, and town of residence except for the percentages of heavy smokers reducing smoking. Due to the small number of heavy smokers only age and social class could be adjusted for. However, the effects of town of residence on changes in smoking are small.

† Data missing on 12 men.

‡ Data missing on 30 men.

§ Significantly different from the percentage of continuously employed men ( $p<0.05$ ).

TABLE III—Alcohol consumption at initial screening and postal questionnaire five years later and changes in alcohol consumption. Figures are adjusted percentages of men\* unless otherwise stated

Employment status at postal questionnaire	Initial screening			Postal questionnaire			Changes in alcohol consumption	
	No of men†	Non-drinkers	Heavy drinkers	No of men‡	Non-drinkers	Heavy drinkers	Drinkers reducing	Heavy drinkers reducing*
Continuously employed	4411	5.6	9.0	4354	8.4	3.9	34.9	74
All non-continuously employed	1644	5.4	12.1§	1628	10.8§	4.1	42.2§	76
Discontinuously employed	447	4.5	12.1§	444	8.2	3.7	39.2	73
Unemployed through illness	129	10.4§	15.8§	127	23.8§	6.5	54.1§	76
Unemployed for other reasons	375	5.2	14.1§	372	11.1	4.7	43.2§	73
Retired through illness	211	6.8	13.8§	207	16.7§	2.7	50.2§	86
Retired for other reasons	482	4.4	8.9	478	6.9	4.1	37.9	75
Test of heterogeneity of percentages among the non employed $\chi^2$ on 4 degrees freedom		8.2 p=0.085	7.48 p=0.113		40.4 p=0.000	3.25 p=0.517	16.72 p=0.002	1.95 p=0.787

\* All percentages adjusted for age, social class, and town of residence except for the percentages of heavy drinkers reducing drinking. Due to the small number of heavy drinkers only age and social class could be adjusted for. However, the effects of town of residence on changes in drinking are small.

† Data missing on two men.

‡ Data missing on 75 men.

§ Significantly different from the percentage of continuously employed men ( $p<0.05$ ).

26.8% of smokers had stopped smoking and only 44.6% of heavy smokers still smoked heavily. Overall, men who had experienced some non-employment were still more likely to be current smokers than men who had remained continuously employed (33.0% *v* 29.3% continuously employed; 1% to 6.5%), but they were no longer more likely to be heavy smokers (7.5% *v* 8.1%; -2.1% to 1.0%). The main changes occurred in men who stated that their non-employment was due to illness, with the percentages of heavy smokers falling from 23.6% to 5.8% for men unemployed through illness and from 16.0% to 3.1% for those retired through illness.

Only 3% of men apparently started smoking after screening, and this did not vary between employment groups. Of the men who smoked at screening, 27.9% of those who had experienced some non-employment after screening had stopped smoking, compared with 26.2% of the men who remained continuously employed (95% confidence interval of the difference -0.1% to 5.8%), with the largest percentages of men giving up being in the groups unemployed and retired through illness and retired for other reasons (table II). Men unemployed for other reasons and those discontinuously employed were slightly less likely to stop smoking (not significant). The test of heterogeneity shows that the tendency to stop smoking differed significantly between the non-employment groups. The differences seemed to occur between the ill and the

not ill groups. The probability of giving up was affected by the initial level of smoking (light smokers being more likely to give up). However, adjusting for this had little effect on the percentages quoted.

Analysis of the percentage of heavy smokers at screening who had reduced or stopped smoking by the time of the postal questionnaire gave a similar picture to that for the percentage of all smokers stopping, though the differences between the continuously employed and the non-continuously employed were more noticeable, 53% of continuously employed men reducing their smoking compared with 61% of other men. This was due mainly to 75% of men unemployed through illness and 86% of men retired through illness decreasing their smoking. There was no evidence that men who experienced some non-employment were more likely to increase their level of smoking than men who remained continuously employed. (More detailed tables of changes in smoking by level of smoking are available).

#### ALCOHOL CONSUMPTION

Table III shows the adjusted percentages of non-drinkers and heavy drinkers in the different employment groups both at initial screening and at the postal questionnaire five years later. At initial screening men who later became non-employed were more likely to be heavy drinkers (12.1%) compared with men who remained employed (9%) (95% confidence interval of

the difference 1.3% to 5.1%). Only men retired for reasons other than illness were not more likely to be heavy drinkers than continuously employed men. Overall, the percentage of non-drinkers was similar among men who later became non-employed and those who remained employed (5.4% and 5.6% respectively; -1.2% to 1.5%). The test of heterogeneity indicated that the percentages of non-drinkers did not alter significantly among the non-employment groups.

Five years later the percentage of heavy drinkers had fallen and the percentage of non-drinkers had risen in all groups. Men who had experienced some non-employment were no longer more likely to be heavy drinkers than men who remained employed (4.1% v 3.9%; -0.9% to 1.5%). Such men were more likely to be non-drinkers (10.8% v 8.4% continuously employed; 0.7% to 4.2%) because of the very high percentages of non-drinkers among men unemployed through illness (23.8%) and retired through illness (16.7%). The test of heterogeneity showed that the probability of being a non-drinker differed significantly between the non-employment groups. The differences seemed to be between the ill and the not ill groups.

Overall, only 10.7% of men reported increasing their alcohol consumption compared with 36.9% who reported reducing their consumption. The percentages of men reducing their alcohol consumption were higher in all the non-employed groups compared with the percentage of continuously employed men, with men non-employed through illness being the most likely to reduce their alcohol consumption (54.1% of men unemployed through illness and 50.2% of men retired through illness v 42.2% of all non-employed men and 34.9% of continuously employed men (table III)). The probability of reducing alcohol consumption was affected by the initial level of consumption, heavy drinkers being more likely to reduce their consumption. But adjusting for initial drinking level had no significant effect on the percentages quoted. The heavy drinkers at screening who experienced some non-employment were not more likely to reduce their consumption compared with the heavy drinkers who remained continuously employed. There was no evidence that non-employed men started drinking more heavily.

#### WEIGHT

Table IV shows the adjusted mean body mass index and the adjusted percentage of men underweight or obese within each employment group at initial screening and at the postal questionnaire five years later. At initial screening, the mean body mass index of men who remained employed was similar to that of men who experienced some non-employment later

(25.52 kg/m<sup>2</sup> v 25.40 kg/m<sup>2</sup> who remained employed). However, men who later became non-employed were more likely to be underweight compared with men who remained employed (3.8% v 2.7%; 95% confidence interval of the difference 0.1% to 2.2%). This was mainly because of the high percentage of men unemployed or retired through illness who were underweight. The overall percentage of men who were obese was similar among men who later experienced some non-employment and those who did not. The tests of heterogeneity indicated that the percentages of underweight and overweight men were not significantly different between the non-employment groups.

Five years later the mean body mass index had risen slightly both in men who had experienced some non-employment (25.40 to 25.71 kg/m<sup>2</sup>) and in men who had not (25.52 to 25.77 kg/m<sup>2</sup>). The percentages of men who were underweight had fallen and the percentages of men who were overweight had risen. Men non-employed through illness still had the highest percentage of underweight men, but the percentages were not significantly different from those in the other groups of men.

Men who experienced some non-employment were less likely to remain at a stable weight than men who remained continuously employed, and they were more likely to either lose or gain more than 10% in weight; 2.9% of men who experienced some non-employment lost more than 10% in weight and 7.5% gained more than 10% in weight compared with 2.1% and 5.0% respectively of continuously employed men (95% confidence intervals of the differences 0.1% to 1.8% for weight loss and 0.9% to 4.0% for gain). The higher percentage of non-employed men losing weight was due to the much greater percentages among the men non-employed through illness, whereas the higher percentage of men gaining weight was due to higher percentages in all the non-employed groups.

There was a strong association between cigarette smoking and body mass index, with an increase in body mass index occurring on stopping smoking.<sup>20</sup> It is possible that men who subsequently experienced some periods of non-employment were more likely to gain weight after stopping smoking. Excluding men who stopped smoking from the analysis reduced the percentage of men who gained more than 10% in weight. However, non-employed men were still significantly more likely to gain more than 10% in weight than men who remained continuously employed.

#### PHYSICAL ACTIVITY

Table V shows the adjusted percentages of inactive men in the different employment groups at initial screening before any non-employment had occurred.

TABLE IV—Body weight at initial screening and postal questionnaire five years later and changes in weight. Figures are adjusted percentages of men \*unless otherwise stated

Employment status at postal questionnaire	Initial screening				Postal questionnaire				Changes in weight*	
	No of men†	Mean (SE) body mass index (kg/m <sup>2</sup> )	Underweight	Obese	No of men‡	Mean (SE) body mass index (kg/m <sup>2</sup> )	Underweight	Obese	Loss >10%	Gain >10%
Continuously employed	4412	25.52 (0.05)	2.7	8.1	4333	25.77 (0.05)	2.0	8.4	2.1	5.0
All non-continuously employed	1664	25.40 (0.08)	3.8§	7.9	1597	25.71 (0.08)	2.3	9.4	2.9§	7.5§
Discontinuously employed	446	25.46 (0.15)	3.4	8.6	434	25.74 (0.15)	1.9	9.1	2.2	5.0
Unemployed through illness	129	25.42 (0.27)	6.4§	10.4	123	25.75 (0.28)	4.4	11.3	7.6§	12.0§
Unemployed for other reasons	376	25.44 (0.16)	4.1	8.6	362	25.74 (0.17)	2.2	10.8	2.8	7.1§
Retired through illness	211	25.51 (0.22)	5.7§	7.5	205	25.70 (0.23)	3.6	8.4	5.2§	10.9§
Retired for other reasons	482	25.26 (0.15)	2.4	5.7	473	25.64 (0.16)	1.6	8.1	1.4	7.5§
Test of heterogeneity of percentages among the non-employed $\chi^2$ on 4 degrees freedom										
			7.63 p=0.107	4.7 p=0.320				5.5 p=0.240	0.14 p=0.998	51.03 p=0.000

\*All percentages adjusted for age, social class, and town of residence by fitting a multiple logistic model except for changes in weight which were analysed by fitting a nominal polytomous regression model on six separate weight change categories. Town was not adjusted for. The test of heterogeneity is based on 20 degrees of freedom.

†Data missing on one man.

‡Data missing on 127 men.

§Significantly different from the percentage of continuously employed men (p<0.05).

Men who later became non-employed were significantly more likely to be inactive compared with men who remained employed (39.4% *v* 36.7%; 95% confidence interval of the difference 0.1% to 5.7%). Only men retired for reasons other than illness were significantly less likely to be inactive than continuously employed men (31.6% were inactive; 0.4% to 9.8%).

TABLE V—*Level of physical activity at initial screening*

Employment status at postal questionnaire	No of men*	% Inactive†
Continuously employed	4364	36.7
All non-continuously employed	1623	39.4‡
Discontinuously employed	443	37.9
Unemployed through illness	127	44.1
Unemployed for other reasons	369	44.3‡
Retired through illness	208	48.3‡
Retired for other reasons	476	31.6‡
Test of heterogeneity of percentages among the non-employed $\chi^2$ on 4 degrees freedom		25.21 p=0.000

\*Data missing on 70 men.

†All percentages adjusted for age, social class, and town of residence.

‡Significantly different from the percentage of continuously employed men ( $p<0.05$ ).

The test of heterogeneity indicated that the level of activity significantly differed between the non-employment groups. There was no association between the level of physical activity at screening and the likelihood of gaining more than 10% in weight (data not shown).

## Discussion

### CIGARETTE SMOKING

In agreement with other studies,<sup>1-5 9 21</sup> non-employed men in the British regional heart study smoked more than employed men, but this was because they smoked more heavily before non-employment. The data show that illness was an important factor associated with non-employed men stopping smoking. Men who attributed their non-employment to illness had significantly higher rates of stopping smoking or decreasing smoking than both continuously employed men and men who did not attribute their non-employment to illness. Other studies do not report on the effect of illness on changes in smoking habits among unemployed men, but financial hardship is reported to be a strong incentive to reduce smoking.<sup>22</sup> We did not study any economic measures, but in a study on living standards during unemployment in Great Britain in 1983<sup>23</sup> 53% of the sample reported a loss in family income of more than £30 a week.

### ALCOHOL CONSUMPTION

We have shown that non-employed men were heavier drinkers before non-employment occurred, even after adjusting for age, social class, and town of residence. Once the non-employment had occurred, non-employed men were not more likely to be heavier drinkers, and men non-employed because of illness were actually more likely to be non-drinkers. In agreement with some previous studies<sup>24 25</sup> we found that men who had experienced some non-employment were more likely to have reduced their alcohol consumption than those who remained continuously employed, particularly the occasional and light drinkers. Nevertheless, because of the categorisation of the data we could not determine whether heavy drinkers were at risk of increasing their alcohol consumption, as has been suggested.<sup>26</sup> Men who were non-employed because of illness were the most likely to have reduced their alcohol consumption, indicating that the presence of illness was associated with some men reducing their alcohol consumption. The effect of illness is not reported in other studies. Again our data

do not enable us to comment on financial pressure which may lead to reduced alcohol consumption, as reported in other studies.<sup>28</sup>

### WEIGHT

Since body weight five years after screening was self reported there will inevitably have been some misreporting. Nevertheless, strong correlations have been shown between self reported weight and measured weight.<sup>28</sup> Random misreporting would not in any case bias our findings. Bias would arise if non-employed men were more likely to overestimate their weight than employed men. This seems unlikely to have occurred.

In agreement with other studies<sup>29 30</sup> analysing mean body mass index or mean changes in body mass index did not show any differences between men who remained continuously employed and men who experienced some non-employment. However, before the non-employment occurred there were raised percentages of underweight men in the groups not employed because of illness, strongly suggesting that some of these men had chronic illness. This view is reinforced by the high incidence of substantial weight loss in these two groups by the time of the postal questionnaire. Wannamethee and Shaper found that the men in the British regional heart study cohort who were underweight at the initial screening or who subsequently lost weight were likely to have had impaired health at the initial screening.<sup>31</sup> The percentages of men gaining >10% in weight were higher for all the non-employed groups compared with the percentage of continuously employed men. Wannamethee and Shaper found that a weight gain of more than 10% was associated with increased risk of death from cardiovascular causes over a short period of follow up.<sup>31</sup> This indicates that men who subsequently experienced periods of non-employment not only had a higher prevalence of underlying disease at the initial screening but were more likely to adopt behaviour associated with an increased risk of death from cardiovascular disease. The increased propensity of the non-employed men to gain weight may be due to a reduction in physical activity or to changes in eating habits. We have no data to examine these issues.

### PHYSICAL ACTIVITY

To our knowledge no other studies have reported on the physical activity of men before their non-employment. The non-employed men were less active than the men who remained employed, apart from the men retired for reasons other than illness. Studies have shown that a low level of physical activity is associated with increased risk of death from cardiovascular mortality disease.<sup>32</sup> We have no data to examine any changes in physical activity.

## Conclusion

In this group of British middle aged men the only evidence of those who experienced non-employment adopting behaviour detrimental to their future health was the increased propensity to gain a large amount of weight (>10%). This was not detected if only the mean weight change was analysed. The high levels of smoking and alcohol consumption observed in non-employed men were due to these men being more likely to be heavy smokers and drinkers before the non-employment occurred. There was a strong relation between illness, non-employment, and changes in body weight, alcohol consumption, and cigarette smoking. The men who stated that their non-employment was due to illness were much more likely to lose weight and to reduce their levels of smoking and drinking than both other non-employed men and men remaining continuously employed. It should be emphasised that the

groups of men non-employed through illness are likely to be heterogeneous with regard to type and severity of illness. Thus for some men, but not all, illness will be directly responsible for their weight loss and reduction in smoking and drinking.

This study indicates the need to take account of the long term effects of higher levels of smoking and alcohol consumption and less exercise before unemployment when comparing mortality and morbidity among groups of unemployed and employed people, such as in the Office of Population Censuses and Surveys longitudinal study.<sup>33</sup>

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## Relation of bronchioloalveolar carcinoma to tobacco

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### Abstract

**Objective**—To determine whether bronchioalveolar carcinoma is related to tobacco use.

**Design**—Case-control study.

**Setting**—11 teaching hospitals of Chicago, Long Island, New York, and Philadelphia, 1977-89.

**Subjects**—87 patients with histologically diagnosed bronchioloalveolar carcinoma (cases) and 286 non-cancer and 297 cancer patients matched to cases on age, sex, race, hospital, and date of admission.

**Results**—10% of male cases and 25% of female cases had never smoked. Relative risks of bronchioalveolar carcinoma (as estimated by the relative odds) were greater for subjects who started smoking at a younger age, smoked for a longer time, or smoked more cigarettes per day. Relative risks decreased proportionally to the duration of smoking cessation.

**Conclusion**—Smoking plays an important part in the aetiology of bronchioloalveolar carcinoma but is not the only potential cause because of the large proportion of never smokers among patients with this disease.

### Introduction

Bronchioloalveolar carcinoma is a well differentiated adenocarcinoma growing as a single layer of malignant cells within the alveolar space.<sup>1,2</sup> It is generally

accepted that bronchioloalveolar carcinoma is clinically and pathologically distinct from other cell types of lung cancer.<sup>3,4</sup>

Current knowledge of the role of tobacco smoking in the aetiology of bronchioloalveolar carcinoma originates from series of patients with lung cancer that showed a higher proportion of non-smokers among patients with bronchioloalveolar carcinoma than other lung cancer cell types.<sup>3-8</sup> To our knowledge, though, there are no cohort or case-control series that formally determined the relation of bronchioloalveolar carcinoma and tobacco smoke. The resulting impression is that smoking is unimportant in the aetiology of bronchioloalveolar carcinoma.<sup>9</sup>

Between 1977 and 1989, 87 patients with histologically confirmed bronchioloalveolar carcinoma were interviewed in the longstanding case-control study of tobacco related diseases conducted by the American Health Foundation. This offered an opportunity, using a rigorous epidemiological design, to determine whether cigarette smoking is related to bronchioloalveolar carcinoma.

### Methods

The present data come from the hospital based case-control study of the American Health Foundation that has been described in detail elsewhere.<sup>10</sup> Between 1977 and 1989, 4913 patients with lung cancer were interviewed in 11 teaching hospitals in Chicago, Phila-

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